MULTIPLE CARRIER GATEWAY SYSTEM, METHOD AND APPARATUS

This application claims priority to U.S. provisional application No. 60/434,288, filed December 18, 2002.

FIELD OF THE INVENTION

The present invention relates to telephony over packet switched data networks. More particularly, the present invention relates to a system, method and apparatus adapted to provide multiple voice communication carriers access to a data network via a single gateway. In other embodiments, the invention may be expanded to include interfacing between plural networks of any type., such as Voice of the Internet (Voip) to Voip, Voip to PSTN, PSTN to PSTN, etc.

BACKGROUND OF THE INVENTION

Data Network Telephony

Data networks such as the Internet are now being used to transmit voice. Such data-network-based telephony networks provide an alternative to public-switched telephone networks ("PSTNs") for placing telephone calls. United States Patent No. 6,404,864 describes data-network-based telephone networks in detail and is incorporated herein in its entirety by reference.

FIG. 1 depicts a schematic diagram of a system **100** for conventional voice communications over a data network. The system includes data network **102** and public-switched telephone networks ("PSTN") **120** and **122**. The specifics of the architectures and communications protocols of such systems are not described herein

except to note that they are quite different from one another such that direct communication there between is not possible without converting formats, protocols, etc. It will be appreciated that while two PSTNs (*i.e.*, PSTN **120** and **122**) are depicted, there is, at least functionally, only one worldwide PSTN.

System **100** therefore also includes gateway **110** that acts as a conduit between PSTN **120** and data network **102**, and gateway **112** serving as a conduit between data network **102** and PSTN **122**. In general a gateway is an entrance to and an exit from a communications network. A gateway is typically an electronic repeater device that intercepts and translates signals from one network to another. A gateway often includes a signal conditioner that filters out unwanted noise and controls characters. In data networks, gateways are typically a "node" on both networks that connects two otherwise incompatible networks. Thus, gateways often perform code and protocol conversions. Such an operation would be required for communication between a PSTN and a data network. Assuming an analog voice signal is delivered from the PSTN, the gateway digitizes that signal from the PSTN and encodes it and transmits it as "packets" (hereinafter "digitized voice signal") over the data network according to data network protocols. In other embodiments, the signal from the PSTN is a digital signal, such that analog-to-digital conversion is not required. Protocol conversion is still required.

An element associated with a gateway is a "gatekeeper." A gatekeeper is responsible for gateway registration, address resolution and the like. A gatekeeper may be viewed as the route identifier that directs a digitized voice signal to a "terminating" gateway (*i.e.*, a gateway that provides protocol conversion for transmission over a PSTN, for

example, to a telephone). A gatekeeper is charged with determining the best routing for connecting a particular call from a caller device to a callee device. A gatekeeper is an example of an intelligent node that determines routing information. For purposes of explanation herein, we use a gatekeeper system, although it is understood that the gatekeeper is not the only manner of implementing the intelligent node, and that any type of computer may serve the same function. Moreover, it is also possible that in some circumstances the intelligent node and the gateway may be built on the same hardware platform.

The system further includes telephone **130** that is connected, via link **L1**, to PSTN **120** and telephone **136** that is connected, via link **L8**, to PSTN **122**. The links that are depicted in FIG. 1 are, as is well known, trunk lines, trunk groups, *etc.*, as appropriate.

In operation, voice message **140** from telephone **130** is transmitted over link **L1** to PSTN **120**. Within PSTN **120**, voice message **140** is routed to switch **S2** over link **L2**. Switch **S2**, the operation of which is well known in the art, will typically route voice message **140** to another switch (not shown) over a trunk group (not shown). In such a manner, voice message **140** moves through PSTN **120** being routed from switch to switch until it is carried over a final link **L3** out of PSTN **120**. Voice message **140** is then carried, over link **L4**, to gateway **110**.

"Originating" gateway **110** performs protocol conversion and digitizes, as required, voice signal **140**. Voice message **140** is then routed (the gatekeeper's function) into data network **102**. For clarity of presentation, the voice message will be

assigned the same reference numeral (*e.g.*, **140**), notwithstanding the fact that the signal carrying the message is physically changed during transmission through the system.

Message **140** is transmitted over call path **DNCP** to "terminating" gateway **112** wherein the signal leaves data network **102**. Note that the designation "originating" or "terminating" applies on a call-by-call basis. In other words, for a first call, a particular gateway can be an originating gateway, while for a second call, that same gateway can be a terminating gateway. Moreover, packets typically flow in *both* directions since both parties typically talk.

A call path through a data network, such as call path **DNCP** through data network **102**, is not fixed according to a defined hierarchy as in a PSTN. Rather, an originating gateway "selects" a terminating gateway and the voice signal is routed by successive network elements (*e.g.*, routers, bridges, *etc.*) through the data network to the terminating gateway. Typically, there is a set of rules that is executed in the system in order to ascertain the appropriate terminating gateway or other routing to use. These rules are executed for each call, and are often executed at an intelligent server that is remote from both the originating gateway and the terminating gateway. Often, the communication involves sending one or more parameters of the call (e.g. the called number) from the gateway to the intelligent node, executing some routing rules at the intelligent node, and returning a response that specifies one or more terminating

gateways that can be used to complete the call. Since routing decisions are made by each network element, call path **DNCP** is not *a priori* known or set.

Gateway **112** receives voice message **140** and converts it to a form suitable for transmission through PSTN **122**. Voice message **140** is delivered over link **L5** to PSTN **122**. Within PSTN **122**, voice message **140** is routed via over links, such as link **L6**, to switches, such as switch **S4**. Voice message **140** is carried over link **L7** out of PSTN **122** to link **L8** to telephone **136** to complete the call.

Currently, in order for a VoIP termination network provider to maximize service offerings such as but not limited to prepaid calling card services, the only options are to add originating gateways or add local PSTN dial-in access to originating gateways. It would be advantageous and cost effective to add local PSTN access rather than add more gateways. However, a significant drawback to the prior art is that each gateway is limited in that only one carrier can be associated with a given gateway. All of the functions associated with authorization, accounting, and authentication are implemented for the carrier either at the gateway or at a remote server connected to the gateway.

Due to the above present day architecture, it is difficult to distribute the initial and maintenance costs of gateways among plural carriers. As such, a need exists for a data-network-based telephony system that provides a gateway that can accommodate more than one carrier.

SUMMARY OF THE INVENTION

The present invention provides a system, method and apparatus for providing a gateway to which more than one carrier may be assigned.

To implement such an approach, calls to originating gateways must be identified such that they are associated with a given carrier. In the embodiments described herein such identification is achieved by (1) assigning to each carrier identifying indicia that can be associated with a call; (2) storing such information in memory associated with said gateway; (3) reading data associated with an incoming call; (4) comparing said data of an incoming call to stored carrier-identifying data; (5) if said data corresponds to a given carrier, granting access to said call through said originating gateway to a carrier – operated server; (6) if said data does not correspond to any carrier associated with said gateway, terminating the call. In a preferred embodiment once the call is authenticated an IVR script from another server or node associated with a particular carrier may "answer" the call.

Calls to a gateway are identified by a property or properties that enable a gateway to identify a call as being associated with a particular carrier. Such properties may include information such as a prefix or suffix appearing in the sequence of dialed digits, which may include digits associated with a calling card, electronic token, a PIN, a URL, a bit embedded in the data, or the like. Alternatively in a preferred embodiment a gateway is provided having more than one port wherein each port is associated with a particular carrier. The identifying properties may also be out of band, such as information contained

in SS7 signaling or the like. Calls routed through particular ports are authenticated and routed to a server, node, etc. owned or maintained by the corresponding carrier.

Alternatively, the functionality of the plural servers may be implemented in plural software modules in the gateway or a separate device, with the appropriate software module being executed at the gateway or separate device

The server associated with the particular carrier may then authenticate the call, perform an IVR script, execute any required billing and accounting software, or perform any other call related functions deemed necessary by the operator and/or owner of said servern and carrier.

A call identification scheme according to the present invention may use any of the foregoing properties mentioned hereinabove or any other identification means that would be well known to one skilled in the art.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 depicts voice communications over a data network in the prior art;

FIG. 2 is a flow diagram of a preferred embodiment according to the present invention;

FIG. 3 is a flow diagram of a preferred embodiment of the present invention;

FIG. 4 depicts a preferred embodiment according to the present invention; and

FIG. 5 is a tabular representation of a preferred embodiment according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention solves the above and other problems of the prior art by permitting a single gateway to be associated with more than one carrier.

Before one or more embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction or the arrangements of components set forth in the following description or illustrated in the drawings (the terms "construction" and "components" being understood in the most general sense and thus referring to and including, in appropriate contexts, methods, algorithms, processes and subprocesses). The invention is capable of other embodiments and of being practiced or being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as in any way limiting.

For purposes of illustration, the invention will be described within the context of the following exemplary scenario: a telephony over data-network system, utilizing the Internet as the data network, and effectuating telephone calls between various destinations around the world. A destination can be a city, a part of a city, or, as is convenient in most telephony applications, a set of telephone customers served by a certain common set of digits in a telephone number, such as an area code (e.g., 212), or an area code plus an exchange (e.g., "212-455") or any other defined sequence of numbers within a telephone number (e.g., "212-455-9XXX").

For clarity of explanation, the illustrative embodiments of the present invention are presented as a collection of individual functional blocks. The functions that such

blocks represent can be provided using either shared or dedicated hardware, including, without limitation, hardware which can execute software. Illustrative embodiments may comprise general processor and/or DSP hardware, read-only memory (ROM) for storing software performing the operations described below, memory (RAM) for storing computational results and for storing call data, as well as memory for storing pre-established rules and identification data.

Now referring to **FIG. 2**, the general process that comprises the system and method of the present invention is depicted. In block **10** it is determined what data will be used as indicia for identifying the carrier with which a particular call is associated. A system gateway administrator may perform this determination.

In block **20** the selected identifying data are stored in a database accessible by a gatekeeper at an originating gateway.

Calls are connected to the PSTN in block **30** and are received in an originating gateway in block **40**. Data associated with an incoming call is read in block **50** by the gatekeeper and the read data is compared to stored data in block **60**. If the incoming call contains carrier-identifying data corresponding to the assigned data as depicted in block **70** the call is authenticated as being associated with a particular carrier according to block **80**. The call is then connected to the appropriate carrier server according to block **90**.

If said data does not correspond to any carrier associated with said gateway the call is terminated in block **95** or otherwise rejected. For example the gatekeeper may be adapted to recycle the call to block **50** a given number of times to reattempt authorization.

Now referring to **FIG. 3** in a preferred embodiment once the call is authenticated an Interactive Voice Response (IVR) script from another server or node associated with a particular carrier may "answer" the call. In general IVR is a software application that accepts a combination of voice telephone input and touch-tone keypad selection and provides appropriate responses in the form of voice, fax, callback, e-mail and other media. Known IVR applications include bank and stock account balances and transfers, call center forwarding, order entry transactions, surveys, selective information lookup and the like. Typical IVR applications provide pre-recorded voice responses for appropriate situations, keypad signal logic, access to relevant data and the like. As applied to computer telephony integration, IVR applications can hand off a call to a human being who can view data related to the caller at a display. In terms of the present application, IVR can be applied to authorization and accounting functions such as may be required in communications employing a prepaid calling card, electronic token or the like.

Various properties of a call may be employed to identify to a gateway a particular carrier associated with the call. For example, as seen in **FIG. 2** in block **10** such properties may include information such as a prefix or suffix appearing in the sequence of dialed digits such as but not limited to a PIN such as might be associated with a calling card, prepaid calling card, an electronic token, a URL or the like, a bit embedded in the call, or other properties.

Alternatively, in one most preferred embodiment each carrier is assigned a particular port in a gateway. In this way multiple carriers can be assigned to a single gateway. Now referring to **FIG. 4**, for example, gateway **GW1** comprises ports **P1**, **P2** and **P3** and

gateway **GW2** comprises ports **P4-P7**. Carrier servers **C1-C7** are network servers maintained by different carriers. Now referring to **FIG. 5**, each of carrier servers **C1-C7** are assigned a particular port within a particular gateway. Now referring to **FIG. 2**, block **10**, the indicia for identifying the carrier with which a particular call is associated is the port assigned to that carrier for that gateway. Calls sent to a particular gateway in block **40** contain an identifier corresponding to a particular port in that gateway. The call is then authenticated and connected to the appropriate carrier server as in block **90**.

It is noted that the functions implemented by the IVR or other similar systems include authentication, accounting, and authorization (AAA). In the case of prepaid calling cards, the AAA functions may be performed by the third party, as explained above. However, it may also be the case that the port on which the call arrives represents a carrier or other entity that has been preauthorized. Thus, a gateway or system can be built such that calls arriving on ports 1 or 2 automatically are authorized, and calls arriving on ports 3-5 are sent to the appropriate third party for AAA or similar functions. Therefore, the present invention contemplates a gateway or system of gateways in which incoming calls may be routed to a third party for AAA functions, or where the AAA functions may be done locally at the gateway or assumed to have already been done, all depending upon the call characteristic such as arrival port. The gateway or system can thus determine how any particular call should be processed for AAA functionality.

It is also noted that the carriers need not be public carriers, but can be private enterprises or organizations. The term carrier is intended to cover such other entities as well.

It is to be understood that the above-described embodiments are merely illustrative of the invention and that many variations may be devised by those skilled in the art without departing from the scope of the invention. It is therefore intended that such variations be included within the scope of the following claims and their equivalents.